CRITICAL ITEM PRODUCTION SPECIFICATION

FOR

SUPER CRYSTAL VIDEO RECEIVER

3201144 Rev A

19 April 2001

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LIST OF REVISIONS

Rev	Page/Section	Description
A	Cover	Added date and revision information
	3.2.1	Updated electrical requirements to match drawing number G258788, Revision AA, Super Crystal Video Receiver Assembly Critical Item Product Function Specification
	2.2 and 2.3	Removed cancelled military standards
	3.2.1.5 and Table I	Modified Out of Band Response specification from "… DC to F_e-1.6 GHz shall be below Tangential Sensitivity or shall be greater than 3.0 volts below any In Band responses at the same input level" to "… DC to F_e-0.5 GHz shall be below Tangential Sensitivity or shall be greater than 4.0 volts below any In Band responses at the same input level".
	3.2.1.8 Table I and Table III	Modified Load Impedance from "… 93 ohms $\pm$ 10 percent …" to "… 93 ohms $\pm$ 15 ohms …". Added Load Impedance to First Article Test Requirements.
	3.2.1.4B, D	Removed tracking requirements for 100 production units
	4.5.2	Removed Group B inspection requirements
	4.7	Removed test methods section
	7	Removed suggested sources of supply
	2.4 and 4.1	Added ISO-9001 Quality Assurance requirements

TABLE OF CONTENTS

1.0 SCOPE

1.1 This specification establishes the performance, development, and test requirements for a Super Crystal Video Receiver (SCVR) Assembly, with extended dynamic range and improved out of band rejection characteristics.

2.0 APPLICABLE DOCUMENTS

2.1 GOVERNMENT DOCUMENTS

Unless otherwise specified, the revision level and date for each specification or standard cited within this solicitation/contract (including any specifications or standards cited in any drawing, handbook or referenced specification or standard contained within this solicitation) shall be that listed in the Department of Defense (DoD) Index of Specifications and Standards (DODISS), latest issue, latest supplement as of 19 April 2001.

2.2 MILITARY SPECIFICATIONS

MIL-C-39012	Connectors, Coaxial, Radio Frequency, General Specification for

2.3 MILITARY STANDARDS

MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-1285	Marking of Electrical and Electronic Parts

2.4 OTHER PUBLICATIONS

574908	DTP Frequency Codes or EE150-CV-MMO-0101 (C) DTP Frequency Codes (Confidential) Table 1-4 (Definitions for F_e and F_k)
ANSI/ASQC Q9001	Quality Systems Model for Quality Assurance in Design, Development, Production, Installation and Servicing

OTHER PUBLICATIONS

National Institute for Occupational Safety and Health (NIOSH)- The Registry of Toxic Effects of Chemical Substances

3.0 REQUIREMENTS

3.1 ITEM DEFINITION

The Super Crystal Video Receiver (SCVR) Assembly is used in the Band 3 RF Module Assembly of the Band 3 Direction Finding Receiver in the AN/SLQ-32A(V) Electronic Warfare System. Each SCVR Assembly shall output a video pulse, whose magnitude is linearly related to the input power level in dBm over the full RF pass band and extended input dynamic range per paragraph 3.2 of this specification. In addition, the SCVR shall also provide stop band rejection capabilities.

The SCVR Assembly shall be designed using technology necessary to meet the performance and packaging requirements of this specification. The SCVR Assembly shall be mounted within a housing through which conduction cooling shall be provided.

3.2 CHARACTERISTICS

3.2.1 ELECTRICAL REQUIREMENTS

The SCVR shall meet all the requirements specified herein under the operating environment conditions specified in paragraph 3.2.5 over the operating frequency pass band (specified in paragraph 3.2.1.1), and with the DC voltages as specified in paragraph 3.2.1.16 unless otherwise specified.

3.2.1.1 Radio Frequency Pass-Band.

Each SCVR Assembly shall perform, as specified herein, throughout the RF pass band as specified in Table I.

3.2.1.2 Input Voltage Standing Wave Ratio (VSWR).

The VSWR at the RF input, with a 50-ohm characteristic source impedance, shall not exceed the value specified in Table I at input signal levels from -60 dBm to +7 dBm.

3.2.1.3 Electrical Requirements Summary.

A summary of the electrical requirements is listed in Table I.

TABLE I

ELECTRICAL REQUIREMENTS SUMMARY

CHARACTERISTICS	PARAGRAPH	REQUIREMENT
RF Passband	3.2.1.1	F_e to F_k
Input VSWR	3.2.1.2	$\leq$ 2.0:1, 85% of frequency range $\leq$ 2.5:1, 15% of frequency range VSWR may exceed 2.5:1 for 7% of the Frequency range F_e+5.25 to F_e+6.5 to a maximum of 2.85:1. VSWR may exceed 2.5:1 for 7% of the Band @ -28°C to a maximum of 3.0:1.
Transfer Characteristics	3.2.1.4	See Figure 1
RF Input to Video Output	3.2.1.4A	80mV
Tracking Window	3.2.1.4B	+23°C: 80% of all points within $\pm$ 120 mV @ F_e to $\pm$ 90 mV @ F_k, as measured from –50 dBm through +7 dBm. Maximum range for points exceeding the window at +23°C as measured from –55 dBm through + 7 dBm: $\pm$ 136 mV @ F_e to $\pm$ 120 mV @ F_k i.e. mV = 80[1.7-.02(f-F_e)] -28°C, +71°C: 80% of points in a window from $\pm$ 120 mV maximium @ F_e and decreasing linearly to $\pm$ 90 mV maximum @ F_k as measured from –50 dBm to +7 dBm. Maximum range for points exceeding the window at -28°C and +70°C as measured from –55 dBm through +7 dBm:

		± 152 mV maximum @ F_e to ± 136 mV maximum @ F_k i.e. mV = 80[1.9-.02(F-F_e)]
Frequency Flatness	3.2.1.4C	3 dB maximum
Overall Transfer Window	3.2.1.4D	± 2.75 dB maximum
Temperature Variation	3.2.1.4E	2.5 dB maximum
Out of Band Response	3.2.1.5	4.0 V below In-Band response of same input level (DC to F_e-0.5 GHz)
Maximum Input; Level(CW)	3.2.1.6	+22 dBm

TABLE I (CONTINUED)

Maximum Input; Recovery Time	3.2.1.6	$\leq$ 80 ms (+7 dBm CW)
Maximum Input; Level (Peak) Pulse Width 100 ns (maximum)	3.2.1.6.1	0.1 ERG (maximum)
Saturated Output Level	3.2.1.7	$\leq$ 6.0 V
Load Impedance	3.2.1.8	93 ohms $\pm$ 15 ohms and 10 to 50 pF Capacitance in parallel
RF Pulse Width	3.2.1.9	0.1 to 10.0 μsec
Video Output Pulse Rise Time	3.2.1.9.1	43 nsec maximum
Video Output Propagation Delay	3.2.1.9.2	72 $\pm$ 20 nsec, Figure 3
Video Output Sample Window	3.2.1.9.3	50 nsec minimum, Figure 3
Video Output Pulse; Polarity	3.2.1.9.4	Positive
Output Recovery (PW=10 μsec, +7 dBm input)	3.2.1.10	1.5 dB maximum sensitivity degradation in 4 μsec for second pulse, 4 dB maximum pulse, 4 dB maximum sensitivity degradation in 1.8 μsec for second pulse.
Duty Cycle Variation	3.2.1.11	< 80 mV
Output Noise Voltage; AC	3.2.1.12A	40 false alarms (maximum) in

(10 MHz BW)(without CW)		10 seconds (without CW present)
Output Noise Voltage; AC (10 MHz BW) (with CW)	3.2.1.12B	2000 false alarms (maximum) per second (with CW present). A false alarm is defined as any occurrence of output noise voltage exceeding the specified reference voltage.
Pulse Threshold Reference Voltage	3.2.1.12.1	+400 mV

TABLE I (CONTINUED)

Threshold Sensitivity	3.2.1.12.2	50% probability of detection -54 dBm F_e+2.01 to F_e+9.49 -53 dBm F_e+9.5 to F_k -53.7 dBm F_e to F_e+2
DC Output Voltage	3.2.1.13	-123 mV $\pm$ 98 mV, -65 mV DC
Output Stability; Input Range	3.2.1.14	-60 to +20 dBm
DC Inputs	3.2.1.16	+12 VDC $\pm$ 100 mV @ 460 mA max -12 VDC $\pm$ 100 mV @ 220 mA max
CW Rejection: 2 dB max depression in pulse amplitude	3.2.1.17A	-20 dBm CW, with pulse levels > -24 dBm
CW Rejection: 3.7 dB max depression in pulse amplitude	3.2.1.17B	-25 dBm CW, with pulse levels < -24 dBm
Sensitivity Degradation	3.2.1.17.1	$\leq$ 6 dB @ -20 dBm
Input Immunity: Video Noise (DC to 1 GHz)	3.2.1.18	100 mV Peak (maximum)

NAVSEA CRANE Surface Warfare Center Division	SIZE	SCALE	CAGE CODE	DRAWING NUMBER	REV
	A	NONE	12255	3201144	A

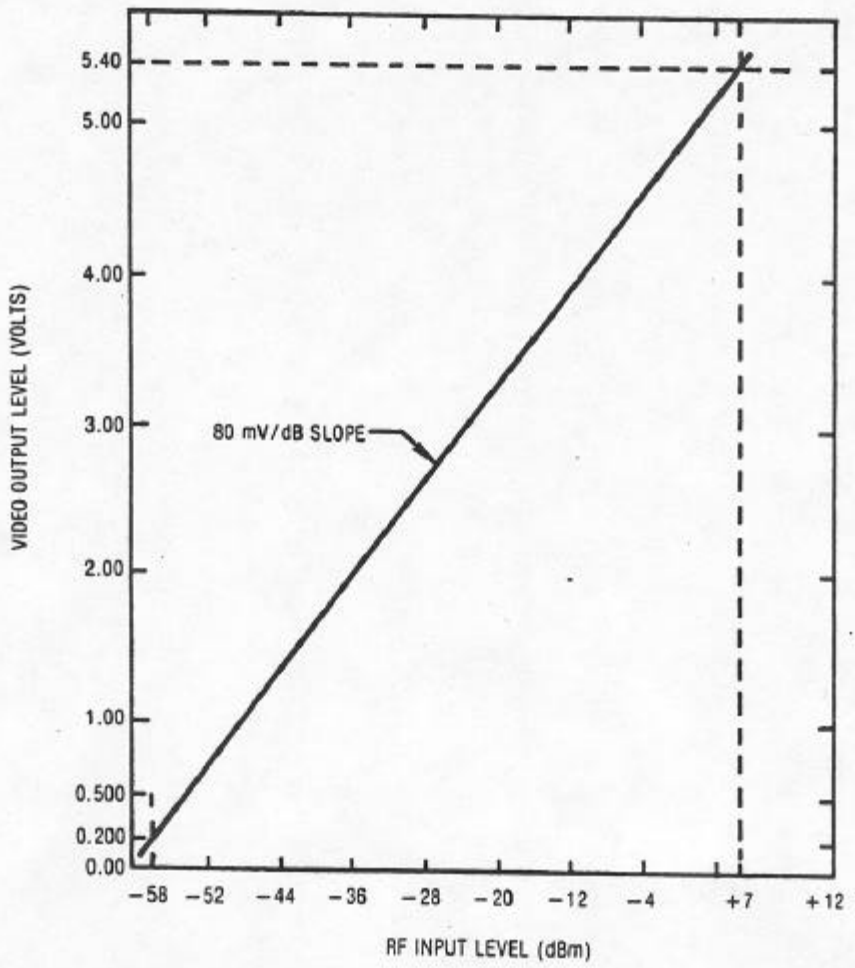

Figure 1. Reference Characteristic Line

3.2.1.4 Transfer Characteristics

An ideal transfer characteristic of the SCVR can be defined as follows:

$$V_o = (P_{in} \times 0.080 \text{ V/dBm}) + 4.840 \text{ V}$$

where P_{in} is the power level of the input signal in dBm. The described ideal transfer characteristic line is shown in Figure 1.

3.2.1.4A RF Input to Video Output Characteristic

The transfer characteristic of the SCVR shall cause the video output to rise at a nominal rate of 80 mV/dB when subjected to RF input pulses from -58 dBm thru +7 dBm.

3.2.1.4B Tracking Window

Any two SCVR's at the same temperature, and the same frequency, shall have a maximum tracking error between them of 240 mV @ F_e and reduce linearly to 180 mV @ F_k. This requirement shall apply to any two RF levels which may be different from each other by up to 10 dB when each are applied to the two SCVR's being compared for tracking.

When tracking determination is to be made between any two SCVR's with different inputs, the output data from one shall be normalized to the other using an absolute slope of 80 mV/dB.

3.2.1.4C Frequency Flatness

At one temperature, the maximum RF power difference needed to produce the same video output voltage over the frequency range F_e to F_k shall not exceed 3 dB.

3.2.1.4D Over All Transfer Window

All SCVRs must meet an overall transfer window of $\pm$2.75 dB maximum about a reference line established from paragraph 3.2.1.4A, B & C which includes the effects of temperature and frequency, at any level within the dynamic range

3.2.1.4E Temperature Variation

At any frequency and input level, the SCVR output must not vary more than 2.5 dB over the specified temperature range.

3.2.1.5 Out-of-Band Response

The SCVR output response to Out-of-Band inputs from DC to F_e-0.5 GHz shall be below Tangential Sensitivity or shall be greater than 4.0 volts below any In-Band responses at the same input level. Those Out-of-Band input signals when coincident with an In-Band input signal shall not cause the In-Band signal's video output to deviate from the requirements of Paragraph 3.2.1.4 unless the Out-of-Band input signal level is $\leq$ 17 dB above the In-Band input level. Out-of-band input levels to be considered shall be $\leq$ +7 dBm.

3.2.1.6 Maximum Input Signals (CW)

No SCVR assembly shall be damaged by a continuous input of +20 dBm either while DC power is applied or while non-operating. Recovery time, from a +7 dBm CW signal level to the Tangential Sensitivity Level, shall be less than 80 ms.

3.2.1.6.1 Maximum Input Signals (Peak)

The SCVR assembly shall not be damaged by a pulse signal applied to its input having the following characteristics and with level as specified in Table I. The maximum pulse width is 100 nsec and the maximum duty cycle is 1.0 percent.

3.2.1.7 Saturated Output

The output pulse voltage for an RF input level above +7 dBm shall monotonically increase with input pulse level but not exceed +6.O V.

3.2.1.8 Load Impedance

Each SCVR assembly shall perform as specified herein when the video pulse output is loaded with a resistance of 93 ohms $\pm$ 15 ohms in parallel with a capacitance of 10 to 50 pF in load impedance.

3.2.1.9 Pulse Characteristics

Each SCVR assembly shall meet the performance requirements of this specification for input signals having pulse widths from 0.1 to 10 usec and pulse rise characteristics are shown in Figure 3.

3.2.1.9.1 Output Rise Time

The rise time of the output video pulse shall not exceed 40 nsec when measured from the 10 percent to the 90 percent amplitude points for input signal levels of from -50 dBm to +7 dBm.

3.2.1.9.2 Propagation Delay

The propagation delay from the 50% power point of the input RF waveform to 90% of the average value of the video voltage within the Video Output Sample Window shall be as specified in Table I and as shown in Figure 3.

NAVSEA CRANE Surface Warfare Center Division	SIZE	SCALE	CAGE CODE	DRAWING NUMBER	REV
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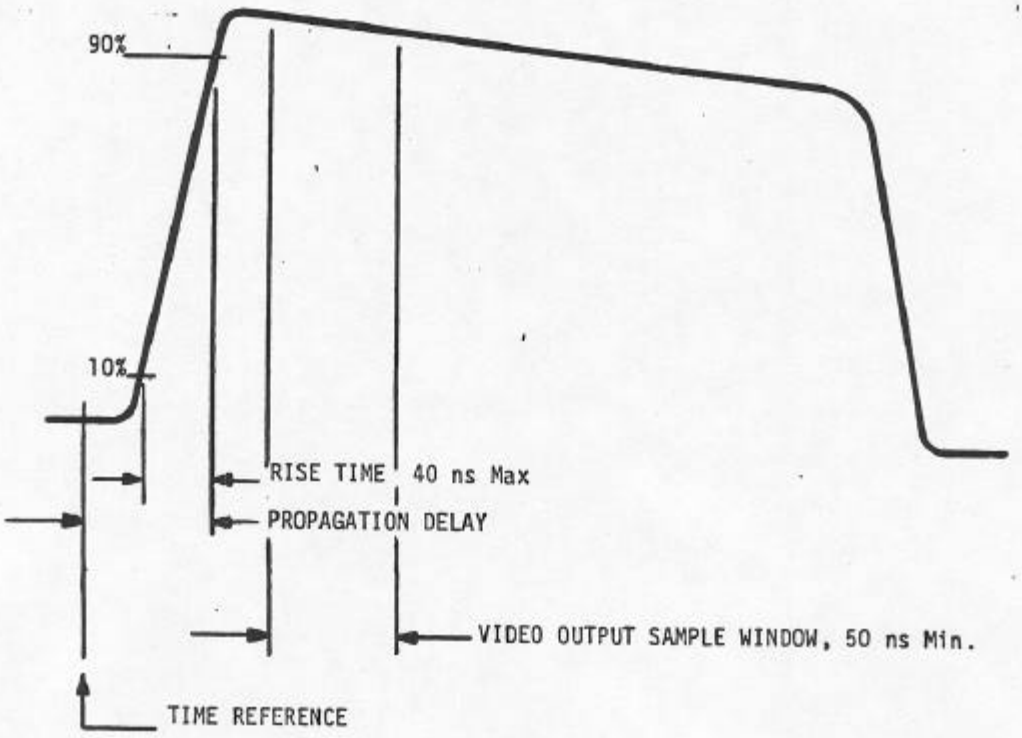

Figure 3. Definition of Output Voltage Pulse Characteristics

3.2.1.9.3 Video Output Sample Window

The video output voltage, including all effects of rise time, overshoot, and droop, shall be within the specified limits of the transfer characteristic paragraph 3.2.1.4 throughout the video output sample window specified in Table I and illustrated in Figure 3. The time reference for measurement of the start and the end of the sample window is defined as the time from the leading edge 50% point of the input RF wave form.

3.2.1.9.4 Output Polarity

The polarity of the video pulse output of each SCVR assembly shall be positive.

3.2.1.10 Output Recovery

For input power levels up to +7 dBm and for pulse widths of 10 μsec or less, the output pulse waveform after the end of the applied pulse shall decrease monotonically to a level of 1.5 dB maximum sensitivity degradation to a second pulse in 4 μsec, and 4.0 dB maximum sensitivity degradation to a second pulse in 1.8 μsec.

3.2.1.11 Duty Cycle Variation

When the pulse repetition interval of a train of 2 μsec RF input pulses is varied from 2000 μsec to 4 μsec the peak output pulse amplitude shall not change more than 80 mV for input signals from -60 dBm to +7 dBm.

3.2.1.12A Output Noise Voltage

With no pulse input signal present the peak output noise voltage shall not exceed the specified reference voltage (Defined in Para. 3.2.1.12.1) above ground more than 40 times over a 10 second period.

3.2.1.12B Output Noise Voltage (CW)

With a CW input signal present at any level within the dynamic range, and no pulse signal present, the output noise voltage shall not exceed the specified reference voltage above ground more than 2000 times per second.

3.2.1.12.1 Pulse Threshold Reference Voltage

The pulse sensitivity reference voltage shall be +400 mV. The RF pulse threshold sensitivity is defined as the RF pulse level required to cause the video output to be $\geq$ +400 mV for a minimum of 50% of the input RF pulses.

3.2.1.12.2 Threshold Sensitivity

The SCVR shall produce a minimum of 50% probability of detection above the reference voltage when subjected to -54 dBm at a frequency of least sensitivity of the SCVR. The SCVR may degrade to -52.5 dBm at a worst case frequency and temperature.

3.2.1.13 DC Output Voltage

With no RF input signal present, the DC output voltage shall be as specified in Table I.

3.2.1.14 Output Stability

For input power levels -60 to +20 dBm and duty cycles up to CW input, the output signal shall have normal stable characteristics with no oscillations or indications of unstable operation.

3.2.1.15 Case Ground Connection

The ground reference for all signal and voltage returns shall be in case ground. A grounding interface shall be provided between case ground and:

a. J1 SMA connector outer conductor (RF Input)
b. J2 Connector Pin (C)
c. J2 Connector Pin (H)

The impedance between the signal and the voltage returns and the case ground shall be sufficiently low so that the following conditions are satisfied:

a. Performance requirement of paragraph 3.2.1.1 through 3.2.1.14 are satisfied when the output termination is referenced between the video output pin and the video return

pin the power return pin or the case, or any combination of the foregoing.

b. Conducted susceptibility shall not exceed the following video output response values when a 4 V pulse, having a current limit resistor of 100 ohms, is applied between the circuit ground connectors pin(s) and the case (a pulse width of 10 µsec and a rise and fall time of 40 nsec).

(1) Leading edge amplitude shall not exceed 0.75 V above case ground (0 V).

(2) Pulse amplitude from 0 to 5 µsec shall recover monotonically from its peak to an average pulse amplitude.

(3) Average pulse amplitude (from 50 to 10 µsec) shall not exceed noise-only amplitude by more than 100 mV peak.

3.2.1.15.1 Connector J2 Assignments

Pin	Use	Notes
A	-12 V	
C	GND	±12VDC Return
E	+12V	
H	GND	Video Out Return
K	Video Out	
B,D,F,J	Internal Test Points	No External Connections

3.2.1.16 Power Requirements

DC power with the following characteristics shall be supplied to the SCVR Assembly.

a. +12 VDC ± 100 mV @ 460 mA max. (J2 Connector Pin "E")

b. -12 VDC ± 100 mV @ 220 mA max. (J2 Connector Pin "A")

The peak-to-peak noise and ripple shall be 100 mV maximum. Proper operation of the unit shall not be affected by the sequence in which power is applied once the voltages are within the specified tolerance.

3.2.1.17 CW Rejection

For an input signal comprising a pulsed signal from -60 dBm to +7 dBm, and an unmodulated CW signal, the range of depression to the pulse signal amplitude shall be as specified in Table I.

3.2.1.17.1 Sensitivity Degradation In The Presence of CW

In the presence of -20 dBm CW, the increase in pulse level necessary to provide a minimum of 50% probability of detection at a temperature frequency of least sensitivity defined in paragraph 3.2.1.12.2 shall not exceed the level specified in Table I.

3.2.1.18 Input Immunity Video Noise

No SCVR assembly shall be damaged or be caused to fail to meet any of the other requirements of this specification because of the presence of video switching noise applied to the input of the SCVR in addition to RF signals to be measured. The limits of the video noise are as specified in Table I.

3.2.2 MECHANICAL REQUIREMENTS

3.2.2.1 Outline and Mounting

Outline drawing is shown in Figure 4.

3.2.2.2 Weight

Weight of the SCVR Assembly shall not exceed 16 ounces.

3.2.2.3 RF Connector

The RF input connector shall be a type SMA receptacle and shall conform to the requirements of MIL-C-39012 for series SMA connectors, with the following exceptions:

a. The connector shall comply with the requirements of Figure 5 including material and finish.

b. The connector shall exhibit a shielding effectiveness of -90 dB, minimum, over the operating frequency range specified herein.

c. The center contact and the dielectric within the connector shall be captivated with respect to the connector body; both parts shall remain within the

specified interface dimensions, and neither part shall displace more than 0.002 inch when subjected to an axial load of 5.0 to 5.5 lb in either direction.

d. The RF input connector (Jl) shall not rotate with respect to the SCVR assembly case nor loosen from the case when 20 in-lb of torque is applied to the body of the connector in either direction.

3.2.2.4 Supply Voltage, Video Output, and Ground Connections

Plus and minus supply voltages, video output, and ground terminals shall be provided via a multipin connector as shown in Figure 4. (Connector to mate with Continental connector no. MMM9SSL.)

3.2.2.5 Cooling

The SCVR Assembly shall be cooled by conduction through the groundplane mounting surface. The SCVR assembly will be mounted on an aluminum heat sink with surface conditions as follows:

Flatness: 0.005 inches maximum, overall

Surface finish: 63

Thermal Compound: Uniformly spread over mounting surface to a thickness of less than 0.005 inch using rake-type applicator.

3.2.3 RELIABILITY

3.2.3.1 Failure Rate

The SCVR Assembly shall have a failure rate of no more than 10 failures per million hours of operation (MTBF > 100,000 hr) when operated under the environmental conditions specified in 3.2.5 thru 3.2.5.10.

3.2.3.2 Useful Life

The SCVR Assembly shall have a useful life of 15 years when exposed to the environmental conditions specified herein. The SCVR Assembly shall have an operational life of 92,000 hours, which will be accumulated randomly during the 15 years.

3.2.4 MAINTAINABILITY

The SCVR Assembly shall be considered a factory repairable item.

3.2.5 ENVIRONMENTAL CONDITIONS

The SCVR Assembly shall meet the specified performance during exposure to any combination of the operating environmental conditions defined within this specification and subsequent to exposure to all of the non-operating environmental conditions, or combinations thereof, defined within this specification.

NAVSEA CRANE Surface Warfare Center Division	SIZE	SCALE	CAGE CODE	DRAWING NUMBER	REV
	A	NONE	12255	3201144	A

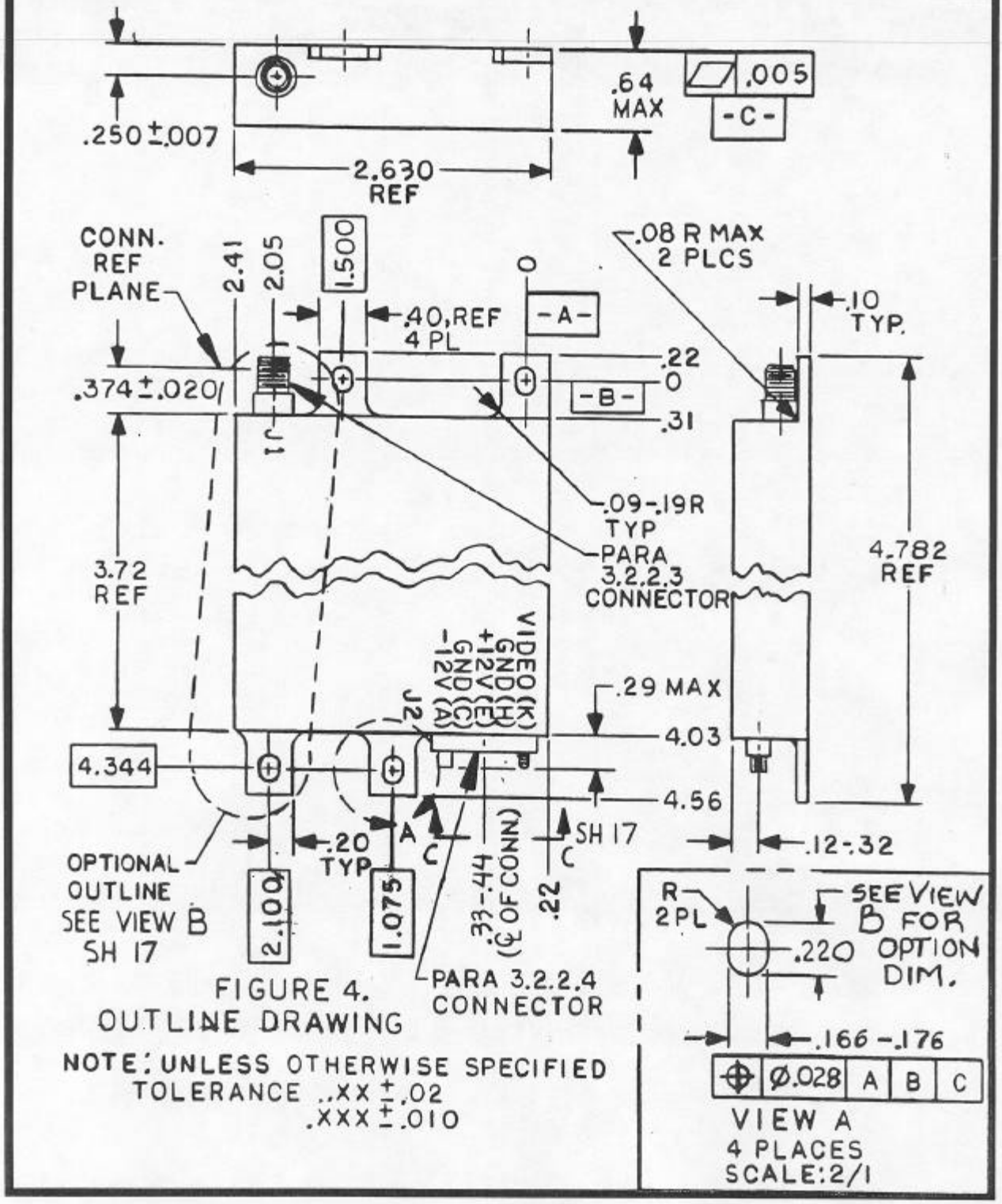

FIGURE 4.
OUTLINE DRAWING

NOTE: UNLESS OTHERWISE SPECIFIED
TOLERANCE .XX ±.02
.XXX ±.010

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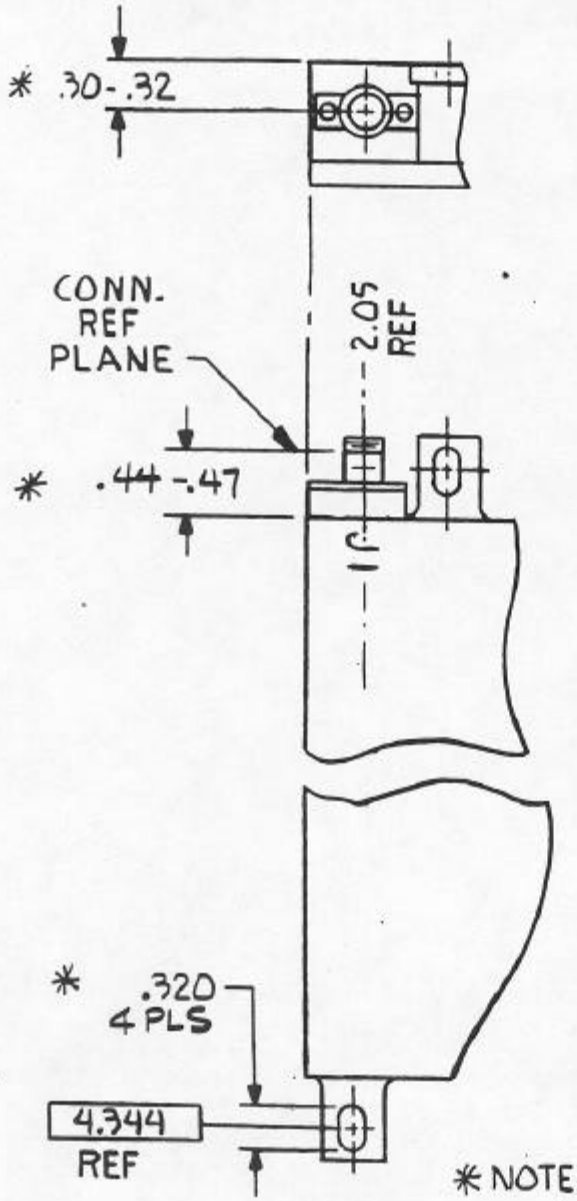
	A	NONE	12255	3201144	A

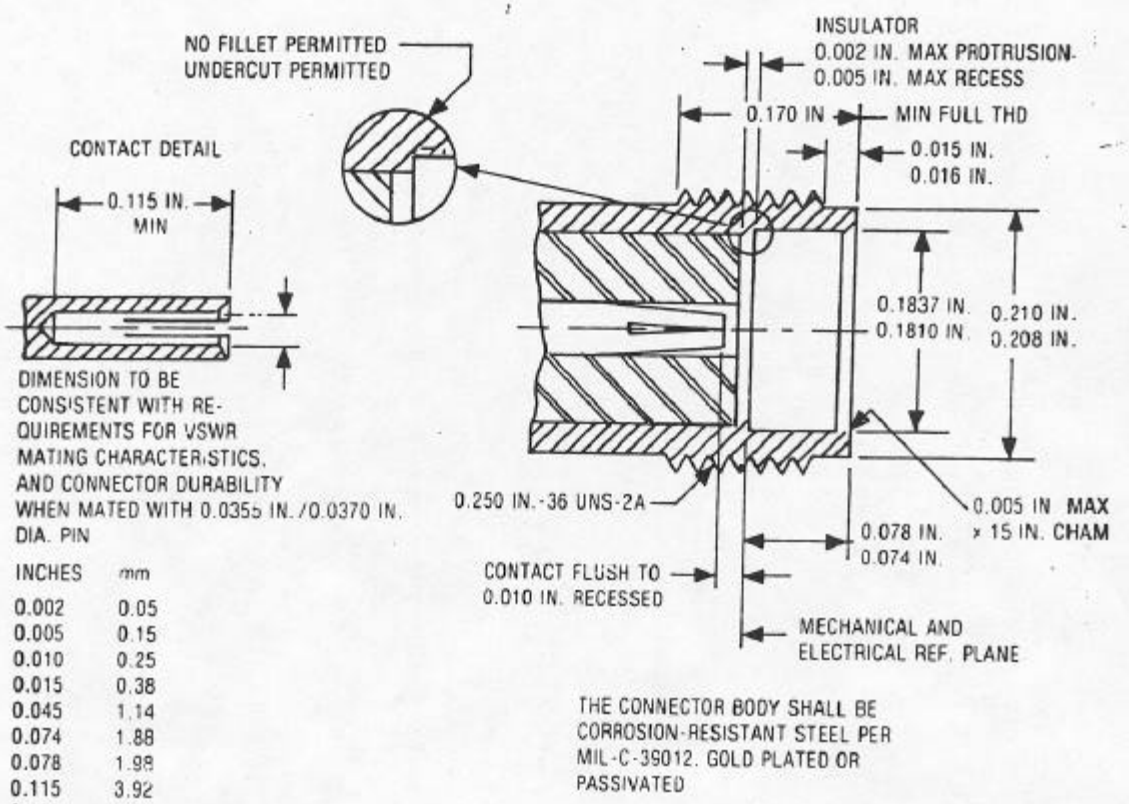


VIEW B
OPTIONAL OUTLINE

VIEW C-C
ROTATED 90° CLOCKWISE
SEE PARA 3.2.1.15.1

* NOTE: WITH .30-.32 AND .44-.47 DIM'S SLOT MUST BE .320, ALL OTHER DIMENSIONS APPLY.

NAVSEA CRANE Surface Warfare Center Division	SIZE	SCALE	CAGE CODE	DRAWING NUMBER	REV
	A	NONE	12255	3201144	A



INCHES	mm
0.002	0.05
0.005	0.15
0.010	0.25
0.015	0.38
0.045	1.14
0.074	1.88
0.078	1.98
0.115	3.92
0.170	4.32
0.1810	4.60
0.1837	4.67
0.208	5.28
0.216	6.49
0.250	6.35

Figure 5. Series SMA Jack and Receptacle Interface

3.2.5.1 Mounting Surface Temperature Range for Full Performance

The SCVR Assembly shall meet all performance requirements specified within this specification when the surface to which the assembly is mounted is at temperatures from -28◦C to +70◦C. (See 3.2.2.5).

3.2.5.2 Overtemperature Operation

Operation for a period of 2 hours at mounting surface temperatures up to +88◦C shall not damage the SCVR Assembly; however, performance degradation is acceptable during the overtemperature condition.

3.2.5.3 Temperature Range (Non-Operating)

The SCVR Assembly shall not be damaged nor shall the operational performance be degraded as a result of prolonged exposure to ambient temperatures from -54◦C to +85◦C while not operating.

3.2.5.4 Altitude

The SCVR Assembly shall meet the altitude conditions listed below. No degradation of the specified performance shall be evident during the operating condition or followed either during the operating condition or followed either condition.

3.2.5.4.1 Altitude, Operating

Sea Level.

3.2.5.4.2 Altitude, Non-Operating

From Sea level to 50,000 feet.

3.2.5.5 Vibration

The SCVR Assembly shall not suffer damage or fail to meet specified performance when subjected to the following vibration frequencies and amplitudes in either the operating or non-operating conditions.

Frequency	Level

4 to 20 Hz	0.5 inch D.A.
20 to 42 Hz	± 10 G

3.2.5.6 Shock

The SCVR Assembly shall not suffer damage or subsequently fail to meet the specified performance when subjected to a 50 G peak acceleration, half-sine waveform, 11 msec duration, in either the operating or non-operating condition.

3.2.5.7 Humidity

The SCVR Assembly shall withstand the effects of up to 100 percent relative humidity continuous and wherein condensation takes place in the form of water or frost.

3.2.5.8 Salt Atmosphere

The SCVR Assembly shall withstand, in both an operating and non-operating condition, exposure to salt atmosphere for a period of 48 hours.

3.2.5.9 Magnetic Field (Non-Operating)

The SCVR Assembly shall withstand 0 to 20 oersteds, with a maximum rate-of-change of 20 oersteds per second.

3.2.5.10 Random Vibration

The SCVR Assembly shall not be damaged by random vibration applied for 10 minutes, with the power spectral density and frequency bandwidth defined in paragraph 4.7.9. The device shall be able to operate during random vibration, but will not be required to meet performance specifications during random vibration. The device shall meet all specified performance requirements following random vibration.

3.3 DESIGN AND CONSTRUCTION

3.3.1 Parts, Material and Processes

3.3.1.1 Construction

Construction shall provide protection to all active and passive elements when exposed to the environmental conditions defined within this specification.

3.3.1.2 Materials

All materials including dissimilar metals which are not within hermetically sealed enclosures shall be selected, processed, and protected to prevent dissimilar metals corrosion. The SCVR Assembly ground plane surface shall be compatible with an aluminum mounting surface. All other parts, materials, and coatings, including markings, external to hermetically sealed enclosures, shall be inherently non-nutrient to fungus. Materials and coating shall not blister, crack, outgas, soften, flow, or exhibit defects that adversely affect storage, operation, or environmental capabilities of SCVR assemblies, under the conditions specified within this specification.

3.3.1.2.1 Safety (personnel hazard)

Materials, identified in The Registry of Toxic Effects of Chemical Substances, which include radioactive materials, mercury, magnesium, and other known toxic or hazardous materials shall not be used without prior permission of NSWC Crane.

3.3.1.3 Flammable Materials

Flammable materials shall not be used in the SCVR Assembly. The supplier shall, upon request, furnish certification that no flammable materials were used in the SCVR Assembly.

3.3.1.4 Solvent Resistance

Exterior materials, finishes, labels, marking, etc. shall be resistant to solvent solutions. Requirements for immersion in the solutions do not apply.

3.3.1.5 Hybrid Microcircuits and Microwave Integrated Circuits

Any part of the SCVR Assembly that is constructed as a hybrid microcircuit shall be designed, constructed, and fabricated in accordance with good engineering practice.

3.3.1.6 Rework

All rework permitted on microcircuits shall be accomplished in

accordance with procedures and safeguards documented by the supplier and available for review by NSWC Crane. All circuit assemblies that have been reworked shall be visually inspected by the supplier.

3.3.1.7 Changes in Design, Processing, or Materials

After acceptance of the first article by NSWC Crane, no change shall be made in design, processes, or materials without prior authorization, in writing, from NSWC Crane. Prior to incorporation of a change, the supplier shall notify NSWC Crane and shall provide a quantitative evaluation of the effect of the change on the quality and performance characteristics of the SCVR assemblies.

3.3.2 Electromagnetic Interference

With the connectors properly mated, the SCVR assembly shall meet the following interference emissions and susceptibility requirements in accordance with MIL-STD-461B, Part 5.

3.3.2.1 Emissions

DC power and interconnecting leads shall conform to CE03. Conducted emissions at the RF connector shall conform to CE06. Radiated emissions shall conform to RE02 with the narrow band limit extrapolated to 18 GHz.

3.3.2.2 Susceptibility

The SCVR shall meet the conducted susceptibility requirement of paragraph 3.2.1.5b herein. It shall also meet the requirements of CS02 except the applied voltage shall be 100 mV peak to peak and the upper frequency limit shall be 50 MHz. Radiated susceptibility shall conform to method RS03 except the upper frequency limit shall be extended to 18 GHz and the field.

3.3.2 Identification and Marking

Each SCVR Assembly shall be permanently marked with the following information:

a. Government CAGE Code, part number and revision letter:
   49956 G258788- REV

b. NSWC Crane CAGE Code, part number and revision letter:
   12255 3201144 REV A

c. Manufacturer's name and CAGE Code

d. Manufacturer's part number

e. Serial number

f. The sensitive electronic device symbol in accordance with MIL-STD-1285

3.3.4 Workmanship

Workmanship shall be in accordance with sound engineering, manufacturing and practices.

3.3.5 Electrostatic Discharge (ESD) Control Program

The supplier shall document and maintain an ESD control program for protection of electrical and electronic parts, assemblies and equipment. Control program requirements shall be flowed down to sub-tier assembly suppliers of those items incorporated into the delivered product.

3.4 DOCUMENTATION

3.4.1 Microcircuit Documentation

The supplier shall maintain processing, manufacturing, and testing instructions for all microcircuits used in the SCVR in order to ensure that alternate microcircuits can be qualified if necessary due to non-availability of the original microcircuit.

3.4.2 Test Reports

A test report shall be provided with each SCVR unit delivered. The test report shall include all test data taken to ensure that the SCVR meets the requirements of this specification (Table III for first article units, Group A Inspection (section 4.5.1) for all other units).

3.4.3 Test Procedures

All SCVR test procedures shall be developed and maintained by the supplier. These test procedures shall be available for review by NSWC

Crane upon request.

4. QUALITY ASSURANCE PROVISIONS

4.1 GENERAL

The supplier shall establish, implement, and maintain a product and quality assurance program in accordance with ISO-9001 certification requirements.

4.1.1 Responsibility for Inspection

The supplier is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified in the contract or purchase order, the supplier may utilize his own facilities or any commercial laboratory acceptable to NSWC Crane. NSWC Crane reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure conformance of the units to prescribed requirements. Unless otherwise specified, objective evidence of the inspections performed must be retained and available for examination.

4.1.2 Examination and Tests

Examinations and tests specified within this specification are:

a. Qualification tests (See 4.2).
b. Reliability prediction. (See 4.3).
c. Screening and burn-in. (See 4.4).
d. Acceptance test. (See 4.5).
e. First article verification. (See 4.6).

4.2 QUALIFICATION TESTS

Qualification tests shall include the measurements and tests listed in Table II.

TABLE II

Test
Visual and mechanical examination
Electrical performance tests

Temperature

Sinusoidal vibration

Impact shock

Humidity

Salt atmosphere

Long-term stability

Random vibration

Electromagnetic interference

4.2.1 Pre-Qualification Tests

All SCVR assemblies submitted to qualification testing shall be devices which have been processed in accordance with the screening and burn-in procedure specified in paragraph 4.4.

4.3 RELIABILITY PREDICTION

The supplier shall predict the Mean-Time-Between-Failure (MTBF) of the SCVR Assembly. The calculations shall be based on a Naval sheltered environment and a SCVR Assembly case temperature of 45◦C. The predicted MTBF shall meet or exceed the requirements in paragraph 3.2.3.1.

4.4 SCREENING AND BURN-IN

All parts of each SCVR Assembly that are of hybrid microcircuit construction or microwave integrated circuit construction shall be subjected to the screening procedures specified in 4.4.1. Each completed SCVR Assembly shall be subjected to the burn-in procedure specified in 4.4.2.

4.4.1 Screening

If the SCVR Assembly contains separate hermetically sealed hybrid microcircuits, these circuits shall be subjected to the following procedures prior to installation within the SCVR Assembly. If the SCVR Assembly contains hybrid microcircuits or microwave integrated circuitry that is sealed only by the SCVR package, the entire SCVR assembly shall be subjected to the procedures.

a. Internal visual inspection (See 4.4.1.1.)

b. Stabilization bake, 24 hours. (See 4.4.1.2.)

c. Temperature cycling. (See 4.4.1.3.)

d. Mechanical shock. (See 4.4.1.4.)

e. Seal test. (See 4.4.1.5.)

4.4.1.1 Internal visual inspection

Prior to sealing, all hybrid microcircuits and microwave integrated circuits shall be subjected to an internal visual examination.

4.4.1.2 Stabilization bake

Prior to sealing, hybrid microcircuits and microwave integrated circuits shall be stored for 24 hours, minimum, at a minimum temperature of +125◦C.

4.4.1.3 Temperature cycling

Temperature cycling shall be performed for 10 cycles. Electrical measurements are not required prior to temperature cycling. Temperature cycling shall be performed after the circuit under test has been sealed and prior to the mechanical shock test.

4.4.1.4 Mechanical Shock

Mechanical shock shall follow temperature cycling. Shock shall be performed in accordance with the requirements defined in (A) and (B) below, except that shock pulses shall be applied in the Y1 orientation only for five impacts.

(A) Individually sealed hybrid microcircuits or Microwave Integrated Circuits (MIC) shall be shocked prior to installation in the SCVR assembly (1500 g, 0.5 msec).

(B) When all internal hybrid microcircuits and MICs are not separately sealed and screened, the complete SCVR assembly shall be shocked (50 g, 11 msec).

4.4.1.5 Seal Test

Each hermetic package shall be subjected to fine and gross leak testing.

4.4.2 SCVR Burn-In

Each completed SCVR Assembly shall be subjected to the following procedures:

a. Pre-burn-in electrical measurements specified by the supplier and approved by NSWC Crane shall be performed.

b. Operation for 168 hr minimum, with the mounting surface maintained at a temperature of +70◦C. Electrical operating conditions during burn-in shall be specified by the supplier and approved by NSWC Crane.

c. Following burn-in, electrical measurements shall be performed as required to verify operation prior to acceptance testing.

4.5 ACCEPTANCE TESTS

Acceptance tests shall consist of Group A Inspections as follows:

4.5.1 Group A Inspection

Group A inspection shall be performed on each SCVR Assembly supplied to this specification. The examinations and test to be performed shall include measurement of all electrical characteristics which are critical for satisfactory performance in the use application or which may vary significantly from unit-to-unit. Group A inspection shall also include visual and mechanical inspection of dimensions, connectors, surface finish, marking, and workmanship. The following tests are required as a minimum:

Acceptance Test Procedure, Group A (100%) @ 22 +3◦C

CHARACTERISTIC	PARAGRAPH	TEST REQUIREMENT
Input VSWR	3.2.1.2	Swept Return Loss F_e to F_k
Transfer Characteristics	3.2.1.4	200 MHz steps across the band @-45 dBm and -10 dBm. Then

		from -55 dBm thru +7 dBm in 5 dB steps at three worst case frequencies. Tests shall be made within the sample window.
Video Output Propagation Delay	3.2.1.9.2	Measure @ -50 and -5 dBm @ 22◦C
Output Noise Voltage	3.2.1.12A	3.2.1.12
Threshold Sensitivity	3.2.1.12.2	-54 dBm F_e +2.01 to F_e +9.49; -53 dBm F_e + 9.5 to F_k; -53.7 dBm F_e to F_e +2 Corrected for temperature measured at frequency of least sensitivity.
DC Output Voltage	3.2.1.13	3.2.1.13
DC Input Current	3.1.1.16	3.1.1.16

4.6 FIRST ARTICLE VERIFICATION

First article verification shall include demonstration of compliance with all the first article verification requirements listed in Table III. Units submitted for first article test shall be produced with parts, subassemblies, equipment, processes and procedures which will be used for production units. Units shall be subjected to screening prior to first article verification testing.

TABLE III. First Article Verification Requirement.

Requirement	Reference	Tests -28◦C	Tests +25◦C	Tests +70◦C	Certification of Compliance
ELECTRICAL REQUIREMENTS					
RF Passband	3.2.1.1	X	X	X	
Input VSWR	3.2.1.2	X	X	X	
Transfer Characteristics	3.2.1.4	X	X	X	
Out-of-Band Response	3.2.1.5	X	X	X	
Maximum input:	3.2.1.6	X	X	X	
Signal level					
Recovery Time					
Saturated Output Level	3.2.1.7	X	X	X	
Load Impedance	3.2.1.8	X	X	X	
Pulse Characteristics	3.2.1.9	X	X	X	
Output Rise Time	3.2.1.9.1	X	X	X	
Propagation Delay	3.2.1.9.2	X	X	X	
Output Overshoot	3.2.1.9.3	X	X	X	
Video Output Sample Window	3.2.1.9.4	X	X	X	
Output Polarity	3.2.1.9.5		X		
Output Recovery	3.2.1.10	X	X	X	
Duty Cycle Variation	3.2.1.11	X	X	X	
Output Noise Voltage	3.2.1.12A	X	X	X	
Output Noise Voltage	3.2.1.12B	X	X	X	
Output Threshold Voltage					
Sensitivity	3.2.1.12.1	X	X	X	
Pulse Sensitivity At					
Output Threshold Voltage	3.2.1.12.2	X	X	X	

DC Output Voltage	3.2.1.13	X	X	X	
Output Stability	3.2.1.14	X	X	X	
Case Ground Connection	3.2.1.15		X		
Power Requirements	3.2.1.16	X	X	X	
CW Rejection	3.2.1.17	X	X	X	
Sensitivity Degradation in the Presence of CW	3.2.1.17.1	X	X	X	
MECHANICAL REQUIREMENTS					
Outline and Mounting	3.2.2.1		X		
Weight	3.2.2.2		X		
RF Connector	3.2.2.3		X		
Multi-pin Connector	3.2.2.4		X		
Cooling	3.2.2.5				X

TABLE III. First Article Verification Requirement. (cont'd)

Requirements	Reference	Tests -28°C	Tests +25°C	Tests +70°C	Certification of Compliance
RELIABILITY					
Failure Rate	3.2.3.1				X
Useful Life	3.2.3.2				X
MAINTAINABILITY	3.2.4				X
ENVIRONMENTAL CONDITIONS	3.2.5	X		X	X*
DESIGN AND CONSTRUCTION	3.3				X

Parts, Materials and Processes	3.3.1		
Construction	3.3.1.1		X
Materials	3.3.1.2		X
Safety (Persl. Hazrd)	3.3.1.2.1		X
Flammable Materials	3.3.1.3		X
Solvent Resistance	3.3.1.4	X	
Hybrid Microcircuits	3.3.1.5		X
Rework	3.3.1.6		X
Changes in Design, Processing or Materials	3.3.1.7		X
Electromagnetic Interference Emissions and Susceptibility	3.3.2.1	X	
Operation from Common Power Bus	3.3.2.2	X	
Identification and Marking	3.3.3	X	
Workmanship	3.3.4	X	

* Verified by qualification tests.

5. PREPARATION FOR DELIVERY

5.1 Packaging, Packing, and Marking for Shipment.

Packaging, packing, and marking for shipment shall be sufficient to ensure that the SCVRs are not damaged during transit. This includes protection and marking for ESD and physical damages.

6. NOTES

None.